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# The materiality of Neo-impressionism harmony: a non-invasive study of Paul Signac "Au temps d'Harmonie"

Emeline Pouyet <sup>1</sup>, Laurence de Viguerie <sup>1</sup>, Philippe Martinez <sup>1</sup>, Philippe Walter <sup>1</sup>

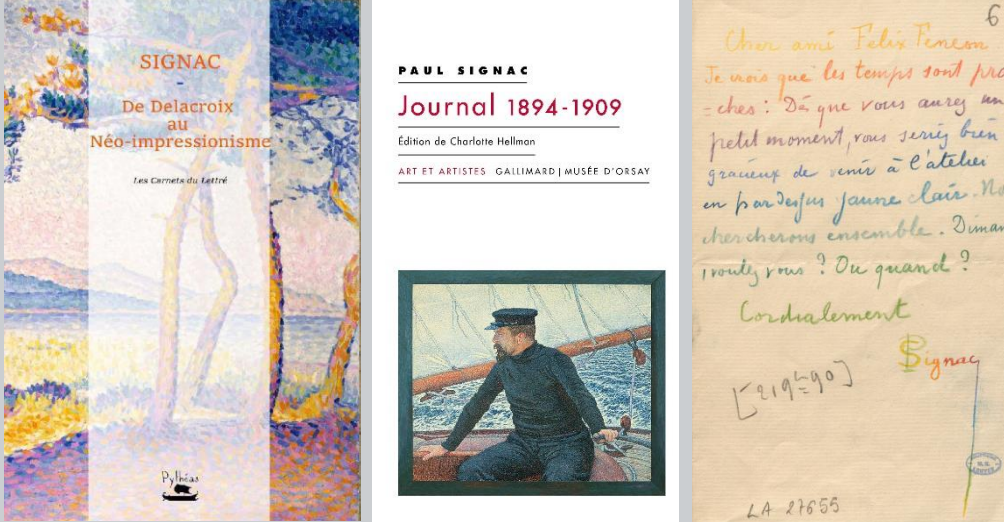
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The late nineteenth and early twentieth centuries were marked by tremendous innovations in art and science. On the one hand, with the rapid rise of the chemical industry, numerous new inorganic and organic pigments were developed and marketed as alternatives to well-established traditional pigments. On the other hand, development of spectrophotometry and the flourishing of numerous treatises on color theory, were soon made available to artists. Equipped with a new prismatic palette and new scientific theories, Neo-Impressionist artists extensively discussed and exploited color mixtures, and by using a variety of painting techniques, they created new facture. In this context, the *in-situ* analytical study of Paul Signac painting materials and techniques represents a unique opportunity to determine the relationships between nineteenth century literature on color theory and its application by the contemporaneous Neo-Impressionist painter.

## AN INTERDISCIPLINARY STUDY : ARCHIVAL INFORMATION, HISTORICAL COLOR THEORY& HISTORICAL PAINTINGS

### The Division : a definition from Paul Signac

d'Eugène Delacroix au Néo-impressionnisme, H. Floury, Libraire-Editeur, 1899



Le néo-impressionnisme ne pointille pas, mais divise.  
Or, diviser c'est :  
S'assurer tous les bénéfices de la luminosité, de la coloration et de l'harmonie, par :  
1° Le mélange optique de pigments uniquement purs (toutes les teintes du prisme et tous leurs tons) ;  
2° La séparation des divers éléments (couleur locale, couleur d'éclairage, leurs réactions, etc...) ;  
3° L'équilibre de ces éléments et leur proportion (selon les lois du contraste, de la gradation et de l'irradiation) ;  
4° Le choix d'une touche proportionnée à la dimension du tableau.

"The Neo-Impressionist does not dot, he divides. Though, dividing is:

Ensuring all of the benefits from brightness, colouring, and harmony by means of:

- 1° The optical mixture of solely pure pigments (all the tints of the prism and all their tones);
- 2° The separation of the different elements (local color, color of the lighting, their interactions, etc.);
- 3° The equilibrium between these elements and their proportions (according to the laws of contrast, of gradation, and of irradiation);
- 4° The choice of a brushstroke is proportional to the dimensions of the painting. "

### Research Objectives

through the development of a dedicated in-house analytical approach

In this context, scientific methods represent an unique opportunity to study Neo-Impressionist artworks to determine:

- the painting material choice made by Paul Signac
- the technique developed to apply and juxtapose the different paint layers as a function of color tint and hue, with regards to contemporaneous color theory
- the evolution of color/material system as a function of time

### Materials study: combination of in situ instrumentation

Technical (UV, IR, VIS) and Hyperspectral (VIS) Imaging



Specim VIS  
Equipped with a long working distance objective OLE140  
400-1000nm  $\Delta\lambda=6nm$   
V10E coupled with CCD (1600 x 1200 pixels)



Model Specim IQ  
400-1000nm  
 $\Delta\lambda=7nm$  (204 bands)  
Image: 512px x 512px

Macro X-ray Fluorescence



MicroScanX  
Rh anode  
Polycapillary optic  
Beam size 150µm  
70mm<sup>2</sup> SDD  
Scan: 30 x 15 cm<sup>2</sup>



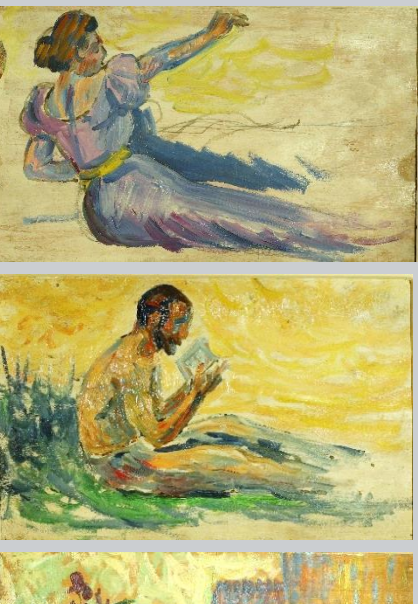
### A series of seven oil on canvas and wood panel for « Au temps d'harmonie »



Esquisse for Au temps d'Harmonie (les iris) n°254- 1893, Paul Signac, Oil on canvas, 26 x 35 cm², Private collection



Studies for Au temps d'harmonie, Paul Signac, Oil on wood panel, Annonciade Museum and Private collection



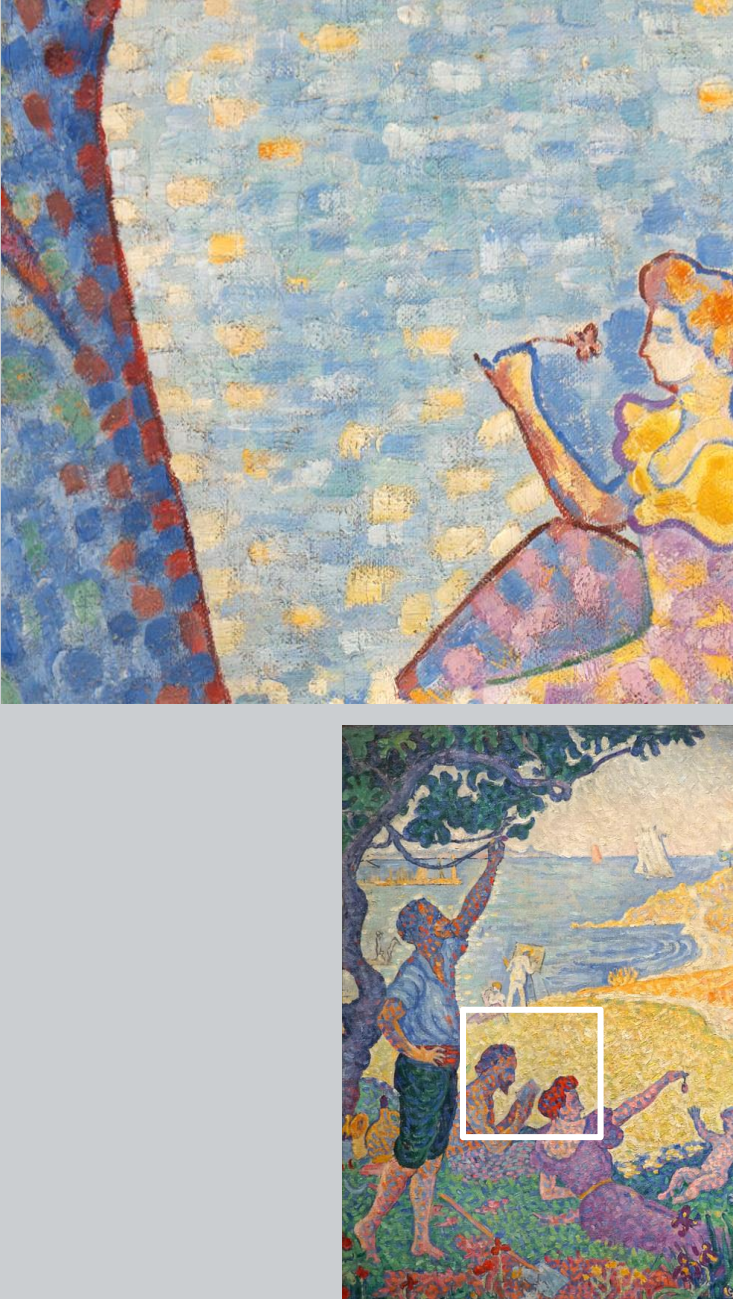
Au temps d'harmonie, Paul Signac, Oil on canvas (1893-1895) 410 x 310 cm², Montreuil City Hall

## CHEMICAL AND OPTICAL PROPERTIES OF “AU TEMPS D’HARMONIE” PAINTING AND RELATED STUDIES

### Drawing and Laws of contrast



Etude pour au temps d'harmonie, Paul Signac, Oil on canvas (1893-1895) 25 x 15 cm², Annonciade Museum



Au temps d'harmonie, Paul Signac, Oil on canvas (1893-1895) 410 x 310 cm², Montreuil City Hall

Drawings were observed for all preparatory studies, with mentions about color , *i.e.* in the above figure ‘v. j.’ for green/yellow, or ‘mer’ for sea. The main area of change of tint and hue are always present in the drawing, highlighting its importance for the gradation of the contrast at the painting scale.

### Paint brushstroke: a single pigment system ?

Yellow : Cadmium yellow, Chromium yellow/orange

Red : Vermilion

Cobalt blue

Green: Emerald green, viridian, cobalt blue, strontium, barium and chromium yellows



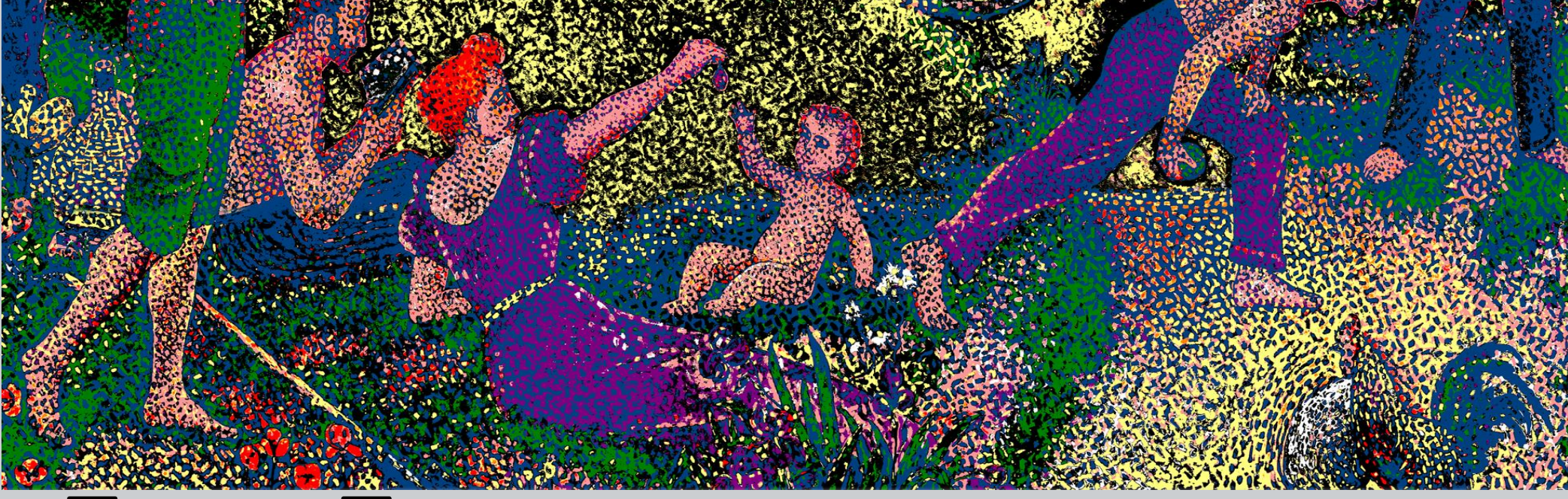
Red: Ochre  
Red: Anthraquinone lake (animals)  
Purple: Ultramarine or Cobalt blue with red lake  
Ultramarine Blue  
Cobalt violet (As, Mn)



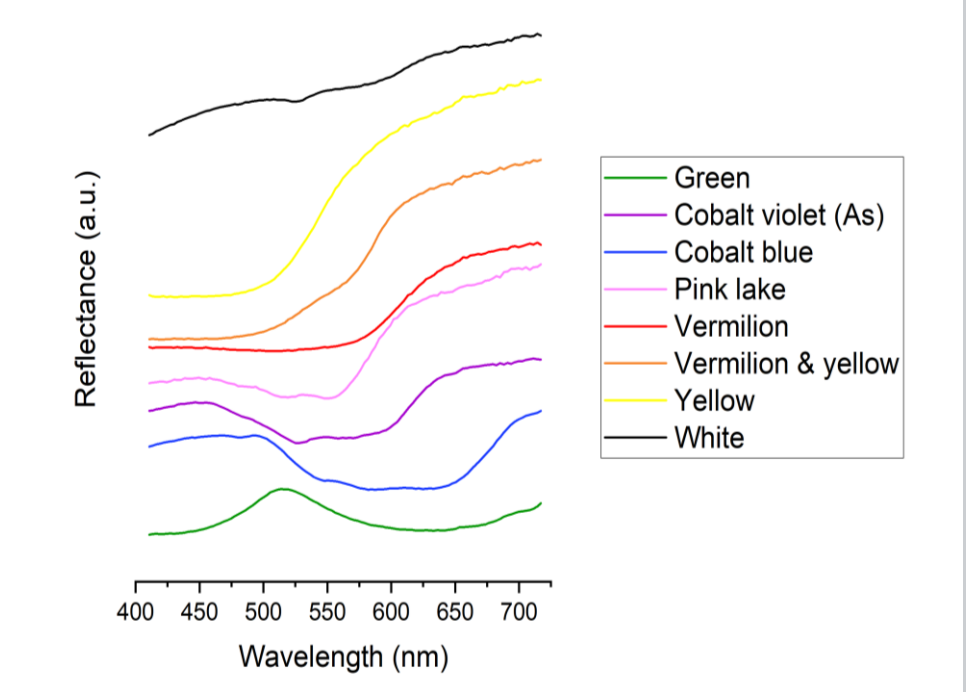
Untitled oil on panels, Paul Signac, private collection (July 15th 1897)

Paul Signac uses a large variety of pigments for the preliminary studies and final painting. Mixtures of pigment are observed for the purple, pink, orange and green color dots, as such pure pigment paint systems were not solely use.

### HSI Dataset



Cobalt Blue Vermilion & yellow Yellow Green Cobalt violet (As) Pink lake White



The main challenge was to perform *in-situ* measurements for the final version of Au Temps d'Harmonie, exposed at 3 meters from the ground and facing a stair with no possibility to work close from the artwork. The long working distance Specim objective allowed acquiring HSI datasets further exploited for comparison with the various painted studies. Using this approach, pigments were identified as: vermilion, green (presumably copper arsenate type), cobalt blue, cobalt violet (arsenate), yellow (presumably chromate yellow), and pink colored anthraquinone dyes. The orange tints are obtained by mixing yellow and vermilion as previously identified in the studies.

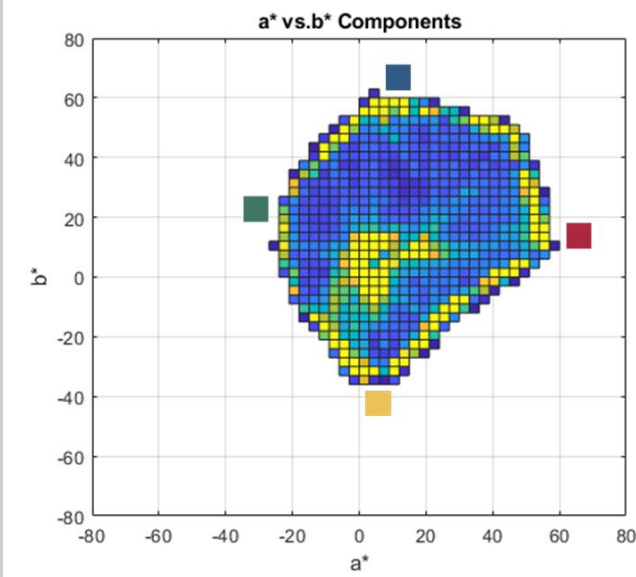
### Chevreul chromatic circle (1st)

Des couleurs et de leurs applications aux arts industriels, Digeon (1855) - BnF

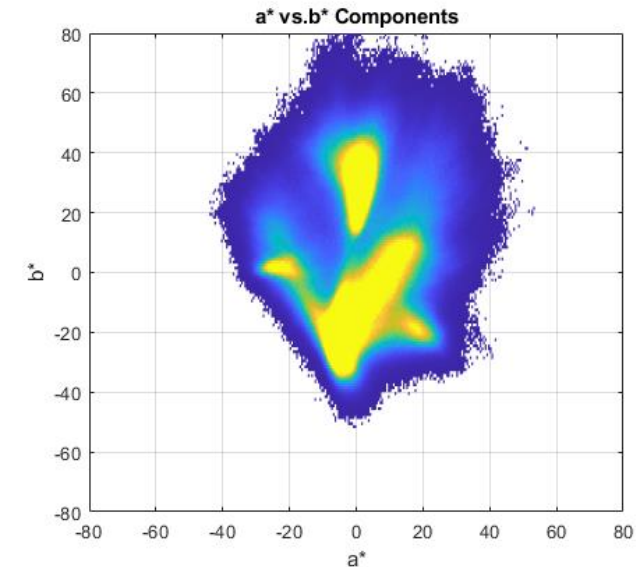


### Color space reference

Chevreul chromatic circle (1st)



Au temps d'harmonie



Overall, this study allows the determination of Paul Signac palette and painting technique, from drawing to juxtaposition of painting dots. The specific study of Au Temps d'Harmonie painting and preliminary studies highlight a change of the use of materials by the artist from 1892 to 1895. The application of long working distance objective for HSI analyses of painted surface in isolated area showed great promises for further development. Finally the combined colorimetric study of contemporaneous colorimetric circles owned by the artist and the paintings confirmed the use of similar color space: approximately circular (in the a\*,b\* chromaticity diagram) and not centered .

1. Roque, G. (1997). Art et science de la couleur: Chevreul et les peintres de Delacroix à l'abstraction. Jacqueline Chambon.  
2. Signac, P. (1899). D'Eugene Delacroix au néo-impressionnisme [Eugene Delacroix on neoimpressionism]. Paris, France: H. Floury, Libraire-Editeur.